Tuesday 10/29/19

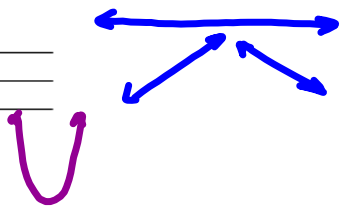
1. Grab the End Behavior Task
2. Find and sit with your "R" Partner
3. One partner grab a laptop
4. EB Task, then Notes

Graphing Polynomials

A function of the form $f(x) = a_nx^n + a_{n-1}x^{n-1} + \ldots + a_1x + a_0$ or $y = a_nx^n + a_{n-1}x^{n-1} + \ldots + a_1x + a_0$ is a **polynomial function** of *degree **n***.

You already know how to graph polynomial functions of degree 0, 1, and 2.

	Degree	Function	Describe the graph of the function
1.	0	$y = a$	Constant
2.	1	$y = ax + b$	Linear
3.	2	$y = ax^2 + bx + c$	Quadratic



If a graph of a function has no breaks we call it **continuous**.

4. Are the graphs in # 1, 2, 3 continuous? ~~contin~~ yes.

5. How many time does the each of the graph "turn"? Degree 0: 0
Degree 1: 0
Degree 2: 1

Graph each of the following polynomial functions on your calculator. Then give the information that is asked for under the equation of the function.

****** SET YOUR WINDOW ON YOUR CALCULATOR (-10, 10, 1, -10, 10, 1, 1)******

	1. $y = x^3$	2. $y = 2x^3 + x^2 - x + 3$	3. $y = -2x^3 - 2x^2 + x - 4$
-Degree:	3	3	3
- Number of turns	0	2	2
-Leading coefficient	1	2	-2
-Does the graph rise or fall on the right?	rise (∞)	rise	fall
-Does the graph rise or fall on the left?	fall ($-\infty$)	fall	rise

	4. $y = x^4$	5. $y = x^4 - 5x^2 + 4$	6. $y = -2x^4 + 3x^2 + 3x + 1$
-Degree:	4	4	4
-Number of turns	1	3	1
-Leading coefficient	1	1	-2
-Does the graph rise or fall on the right?	RISE	∞	Fall
-Does the graph rise or fall on the left?	Rise	∞	Fall

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	7. $y = -x^5$	8. $y = x^5 - 3x^3 + 3$	9. $y = -x^5 + 3x^3 - x$
-Degree:	5	5	5.
-Number of turns	0	2	4
-Leading coefficient	−1	1	-1
-Does the graph rise or fall on the right?	Fall	R	fall
-Does the graph rise of fall on the left?	rise	F	riso

10. What do you notice about the degree and the least number of turns that you found for a function of that degree?

Deg. always bigger

#turns less than deg

turns is always one less than degree

11. What do you notice about the left side vs. the *right* side for functions

… with *odd* degrees? oppos. directions

… with *even* degrees? same direction.

12. What do you notice about the ***right side*** of the graph (the right behavior) for functions

… with *positive* leading coefficients? ALWAYS RISES (∞)

… with *negative* leading coefficients? ALWAYS FALL (-∞)

Use your observations to give the information asked for **without graphing**.

Give (1) the **MAXIMUM** number of possible turns and (2) the left and (3) right behavior of each polynomial function.

	13. $y = -2x^3 + x - 1$	14. $y = x^2 + 2x - 1$	15. $y = 2x + 1$
# of turns	2	1	0
(I.C.) right behavior:	fall(-∞)	∞	∞
left behavior: (Deg.)	rise(∞)	∞	-∞

	16. $y = 2x^6 - 6x^4 + 4x^2 - 2$	17. $y = (x-5)^7 - 3$	18. $y = -2x^{12} + x - 1$
# of turns:	5	6	11
right behavior:	∞	∞	-∞
left behavior:	∞	-∞	-∞

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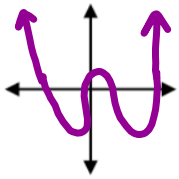
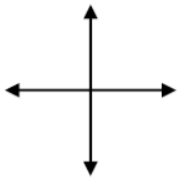
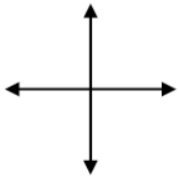
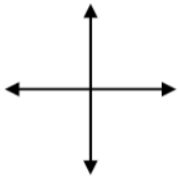
End Behavior of Polynomials

Degree of Polynomial	Leading Coefficient	Picture	End Behavior
Even (same direction)	Positive (+) Right ↑		End Behavior: As $x \to -\infty$, $f(x) \to$ ∞ As $x \to \infty$, $f(x) \to$ ∞
Even	Negative (-)		End Behavior: As $x \to -\infty$, $f(x) \to$ ____ As $x \to \infty$, $f(x) \to$ ____
Odd	Positive (+)		End Behavior: As $x \to -\infty$, $f(x) \to$ ____ As $x \to \infty$, $f(x) \to$ ____
Odd	Negative (-)		End Behavior: As $x \to -\infty$, $f(x) \to$ ____ As $x \to \infty$, $f(x) \to$ ____

Topic: End Behavior **Name:** _____

What am I learning today?

Warm-Up:

1) What is a leading coefficient? # in front de first term.

2) What is the degree of a polynomial? largest exponent

State the degree and leading coefficients of the following:

$-4x^3+3x^2+6x+1$

3) $g(x)=-5x^4+7x^3+2x^2-7$ LC: -5 Deg: 4

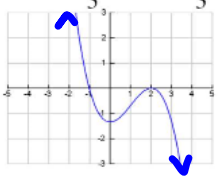
4) $f(x)=3x^2-4x^3+6x+1$ LC: -4 Deg: 3

End Behavior

1. When the degree is odd: (oppos. dirs. ↑↓)

* If the leading coefficient is negative,
the graph rises to the left ($as\ x \to -\infty, f(x) \to$ ∞)
and falls to the right.($as\ x \to \infty, f(x) \to$ -∞)

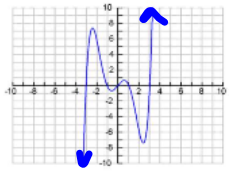
$f(x)=-\frac{1}{3}x^3+x^2-\frac{4}{3}$



Deg: odd ↓↑

* If the leading coefficient is positive,
the graph falls to the left ($as\ x \to -\infty, f(x) \to$ -∞)
and rises to the right. ($as\ x \to \infty, f(x) \to$ ∞)

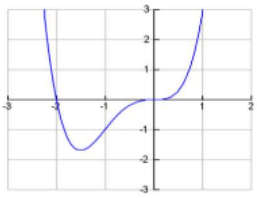
$f(x)=5x^5-2x^3+\frac{9}{5}x$



2. When the degree is even: SAME Dir ↑↑

* If the leading coefficient is positive,
the graph rises to the left ($as\ x \to -\infty, f(x) \to$ ∞)
and rises to the right. ($as\ x \to \infty, f(x) \to$ ∞)

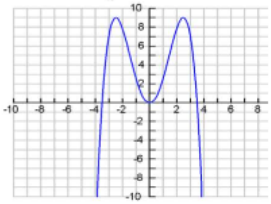
$f(x)=x^4+2x^3$



SAME Dir ↓↓

* If the leading coefficient is negative,
the graph falls to the left ($as\ x \to -\infty, f(x) \to$ -∞)
and falls to the right. ($as\ x \to \infty, f(x) \to$ -∞)

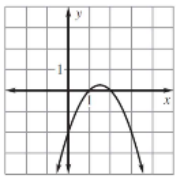
$f(x)=-\frac{1}{4}x^4+3x^2$



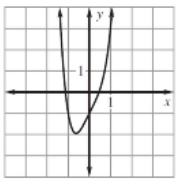
Topic: End Behavior **Date:** _____

Examples
Determining End Behavior

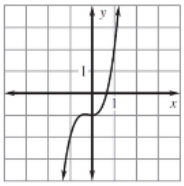
Describe whether the degree is even or odd, the leading coefficient is positive or negative, and the end behavior of the function.

1. 

Degree: Even
LC: Negative
End Behavior: as $x \to -\infty$, $f(x) \to -\infty$
as $x \to \infty$, $f(x) \to -\infty$

2. 

Degree: Even
LC: +
End Behavior: as $x \to -\infty$, $f(x) \to \infty$
as $x \to \infty$, $f(x) \to \infty$

3. 

Degree: odd
LC: +
End Behavior: as $x \to -\infty$, $f(x) \to -\infty$
as $x \to \infty$, $f(x) \to \infty$

4. $y = -2x^3 - 7x^2 + 4x - 1$

Degree: odd
LC: Neg.
End Behavior: as $x \to -\infty$, $f(x) \to \infty$
as $x \to \infty$, $f(x) \to -\infty$

5. $y = 3x^4 + 4x - 2$

Degree: Even
LC: Pos.
End Behavior: as $x \to -\infty$, $f(x) \to \infty$
as $x \to \infty$, $f(x) \to \infty$

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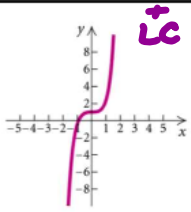
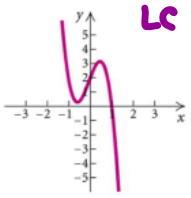
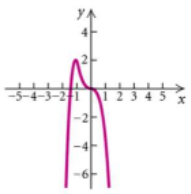
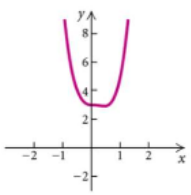
You Try!
Match the graphs with the correct equation

A.  LC: +

B.  LC: −

C. 

D. 

$f(x) = 3x^4 - 2x^3 + 3$ → D

$f(x) = -5x^3 - x^2 + 4x + 2$ → B

$f(x) = -x^6 + x^5 - 4x^3$ → C

$f(x) = x^5 + \frac{1}{4}x + 1$ → A

Summary
Summarize the lesson in your own words